

Assignment

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1) A parallel resonant circuit has $R=100\text{ k}\Omega$ and $L=20\text{ mH}$, and $C=5\text{ mF}$. Calculate ω_0 , ω_1 , ω_2 , Q and B

Soln

$$\omega_0 = \frac{1}{\sqrt{LC}} = \frac{1}{\sqrt{(20 \times 10^{-3}) \times (5 \times 10^{-3})}}$$
$$= 100 \text{ Krad/s}$$

$$B = \frac{\omega_0}{Q} = \frac{1}{RC} = \frac{1}{100 \times (5 \times 10^{-3})}$$
$$= 2 \text{ Krad/s}$$

From the equations above, we know that $\omega_0 = 100 \text{ Krad/s}$ and $B = 2 \text{ Krad/s}$

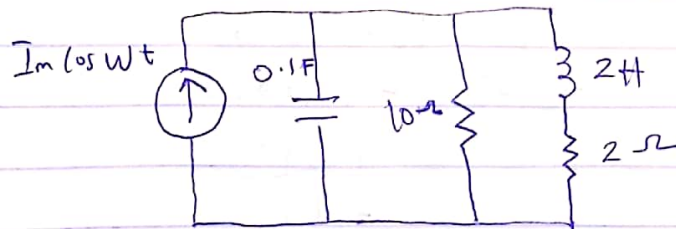
$$\therefore Q = \frac{\omega_0}{B} = \frac{100 \times 10^3}{2 \times 10^3} = 50$$

Since $Q \gg 10$

$$\omega_1 = \omega_0 - \frac{B}{2} = 100 \times 10^3 - \frac{2 \times 10^3}{2} = 99 \text{ Krad/s}$$

$$\omega_2 = \omega_0 + \frac{B}{2} = 100 \times 10^3 + \frac{2 \times 10^3}{2} = 101 \text{ Krad/s}$$

2) Determine the resonant frequency of the circuit



Soln

The input admittance is

$$Y = j\omega 0.1 + \frac{1}{10} + \frac{1}{2 + j\omega 2}$$
$$= 0.1 + j\omega 0.1 + \frac{2 - j\omega 2}{4 + 4\omega^2}$$

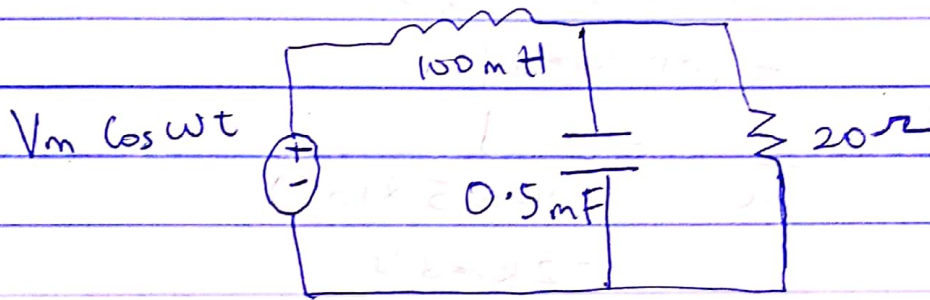
nt Resonance

$$I_m(\gamma) = 0$$

$$\omega_0 \cdot 0.1 = \frac{2\omega_0}{4 + \omega_0^2} = 0$$

$$\omega_0 = 2 \text{ rad/s}$$

3) Calculate the resonant frequency of the circuit below



Soln

$$\frac{20 + \frac{2000}{j\omega}}{20j\omega + 2000} = \frac{40000}{20j\omega + 2000} + \frac{20j\omega - 2000}{20j\omega + 2000}$$

$$\frac{20 + \frac{2000}{j\omega}}{j\omega}$$

$$= \frac{80000j\omega - 80000000}{-400j\omega - 4000000} + 100 \text{ mH}$$

At the resonance of the imaginary part, $\omega = 0$

$$\frac{800000j\omega}{-400j\omega - 4000000} + j\omega (100 \times 10^{-3})$$

$$= 800000\omega + (-40\omega^2) - 400000\omega$$

$$= 400000 - 40\omega^2 = 0$$

$$-40\omega^2 = -400000$$

$$\omega^2 = \frac{-400000}{-40}$$

$$= 10000$$

$$\omega = \sqrt{10000}$$

$$\omega = 100 \text{ rad/s}$$

$$\omega = 100 \text{ rad/s}$$